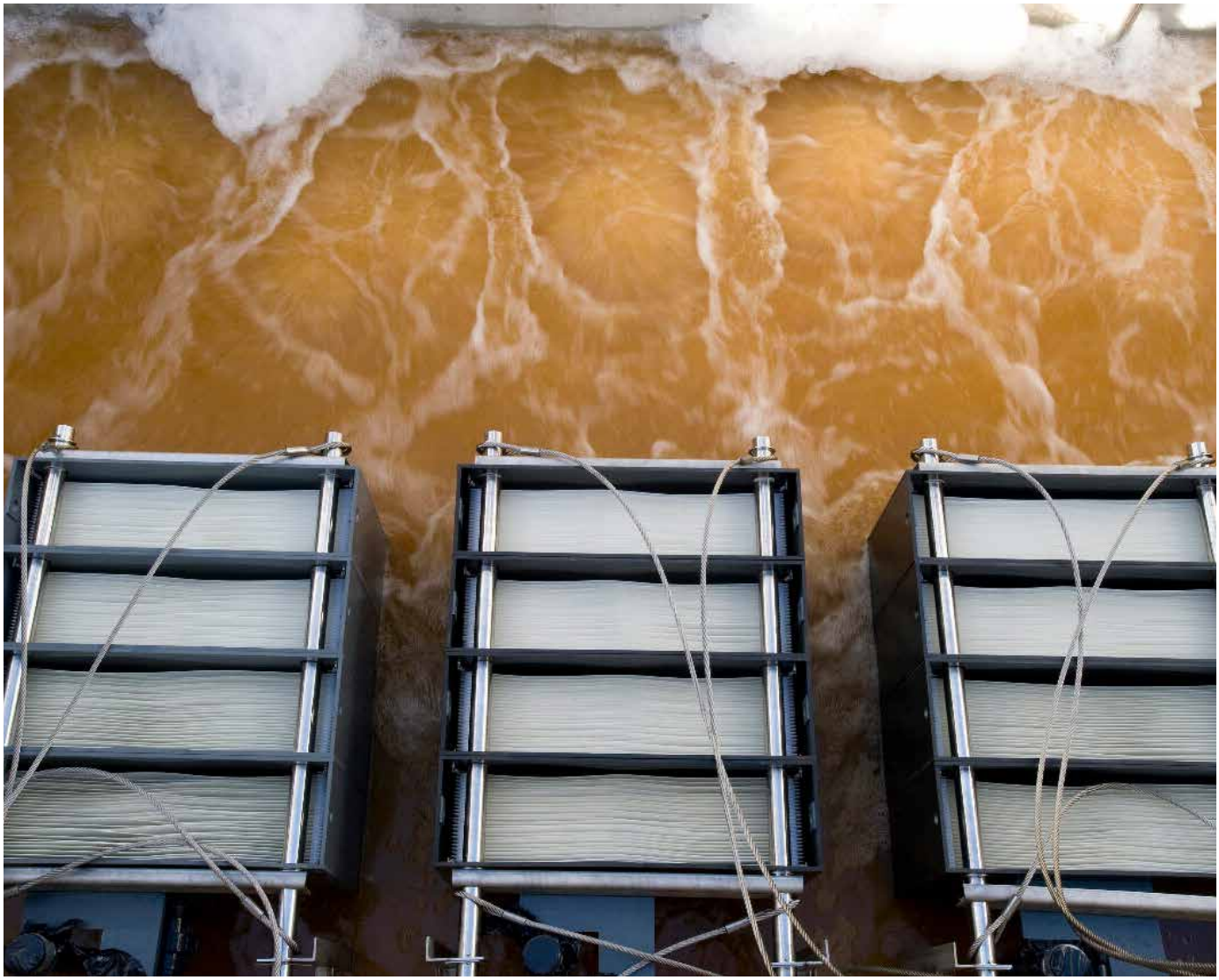
Moving MBR Technology Forward



Leadership in Filtration

MANN+HUMMEL

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BIO-CEL offers a patented self-healing laminate technology, which has been a proven technology for 15+ years and combines the advantages of flat plate and hollow fiber membranes.

Moving MBR Technology Forward

Project Type
Field study & wastewater treatment plant (WWTP) upgrade

Product model
BIO-CEL L+480 with UV400 membrane

Outcome
Replaced previous generation BIO-CEL L-2 UP150 with L+480 UV400, which increased flow capacity, improved effluent quality, and achieved Title 22 equivalency

PROJECT BACKGROUND

A major Casino, which features a 25,000 gallons per day (gpd) wastewater treatment plant (WWTP) operated by Water & Wastewater Services, LLC, was set to expand, ultimately doubling in size, and the WWTP also required increased flow capacity. The MANN+HUMMEL BIO-CEL L-2 UP150, a proven technology used in the original design, demonstrated MANN+HUMMEL's ability to provide a reliable and effective solution. MANN+HUMMEL was, therefore, selected to complete the WWTP expansion and upgrade.

Additionally, the Casino owners permitted a field study to be conducted during the application of the latest generation of the BIO-CEL L+ series and the newly developed UV400T membrane. Furthermore, a major environmental engineering and consulting firm provided third-party data analysis and confirmed Title 22 equivalency.

FAST FACTS

Location:
West Coast, USA

Technology:
MBR, BIO-CEL L+480 with UV400

Application
Municipal wastewater treatment plant

Plant capacity:
280 m^3/d = 73,968 gpd

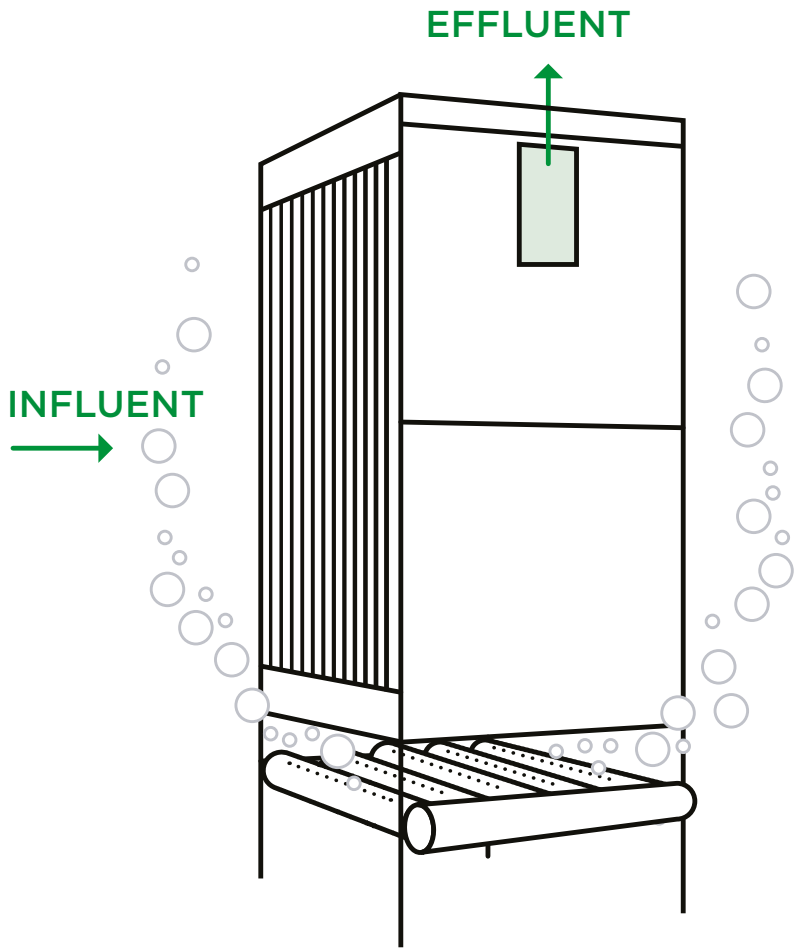
Start-up date
January 2023

Water Type
Municipal wastewater

# of Elements
2

THE NEXT GENERATION: L+ SERIES & UV400T

BIO-CEL MBR provides a cost-effective and scalable solution for meeting challenging effluent requirements for wastewater treatment. The modules produce high-quality effluent at a consistent flow rate, making them ideal for water reuse applications. BIO-CEL offers patented self-healing laminate technology, which has been proven for 15+ years and combines the advantages of flat plate and hollow fiber membranes. The flexible laminate and 360-degree design offer low maintenance, maximizing performance and tank usage in membrane bioreactor applications. The newly developed UV400T membrane offers up to 20% higher average flux and 40% higher peak flux than the previous generation, ensuring high permeability, mechanical stability, durability, chemical resistance, narrow pore size distribution, and excellent effluent quality for reuse.



SUBMERGED MBR

Average influent values

- COD: 617 mg/l
- BOD: 297 mg/l
- Total nitrogen: 30.7 mg/l
- Total suspended solids: 133 mg/l

Average effluent values

- COD: 29.5 mg/l
- BOD: 5.5 mg/l
- Total nitrogen: 1.9 mg/l
- Turbidity: 0.09 mg/l

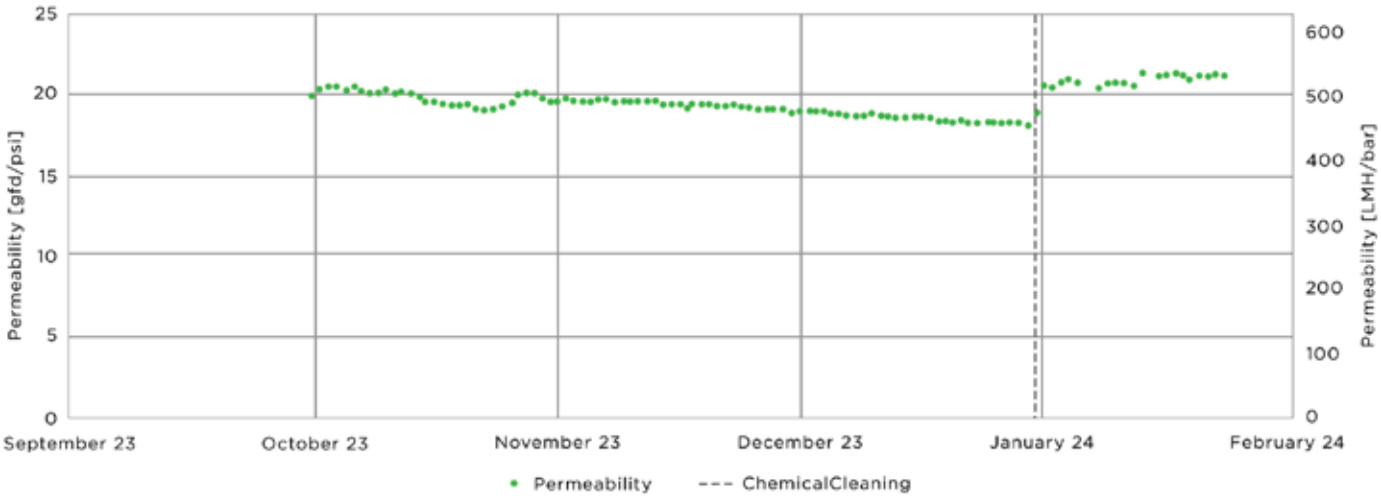
CALIFORNIA TITLE 22 EQUIVALENCY DEMONSTRATION

The State of California has set rigorous Title 22 equivalency standards for testing polymeric membrane products to ensure compliance with specific turbidity criteria. These criteria dictate that membrane-filtered water must exhibit a turbidity of less than 0.2 Nephelometric Turbidity Unit (NTU) at the 95th percentile and should not exceed 0.5 NTU. As part of the field study, we undertook comprehensive testing to demonstrate that our membranes are fully capable of achieving these exacting standards.

Results

A four-month observation period between October 2023 and January 2024 was used to study the BIO-CEL L+480. During the trial period the membrane module was operated at an average flux of 24 LMH (14 gfd) with turbidity monitoring and pathogen sampling throughout the sampling period to validate performance.

PLANT OPERATING CONDITIONS TABLE



The BIO-CEL L+480 with UV400 increased capacity and offered substantial cost savings. It also saved time and significantly reduced chemical consumption and handling, while promoting environmental responsibility and improved safety. The membranes are cleaned once per year, further enhancing operational efficiency. The graphic below provides a detailed description of the influent and effluent permeate depiction during the study.

Commissioning date:
January 2023

Average permeability:
502 LMH/bar (20.1 GFD/psi)

Average TMP:
51 mbar (0.74 psi)

Chemical cleaning agents used:
Sodium hypochlorite (NaOCl)

Chemical cleaning cycle:
Modules were only cleaned twice during the last 13 month of operation: first cleaning before Title 22 trials on 10/4/23, second cleaning on 01/08/2024, before peak flux trials

FIELD PERFORMANCE VALIDATION

The environmental engineering and consulting firm conducted extensive testing and analysis methods, including onsite samplings and maintenance activities, resulting in a detailed technical assessment report. They concluded that the MANN+HUMMEL BIO-CEL L+ UV400 meets turbidity criteria shared by both CA Title 22 and Water Research Foundation (WRF) 4997. The firm also assessed that the technology satisfies the application of WRF 4997 Tier 1 LRVs of 1.0 for virus and 2.5 for Giardia and Cryptosporidium.

The test protocol follows the guidelines of WRF 4997 with indicator microorganisms relevant to MBR validation testing were evaluated weekly during the trial. This includes a default log reduction value (LRV) that can be credited to MBRs conditional on product type and turbidity compliance which are known as Tier 1 LRVs. The Tier 1 LRV requirements per WRF 4997 are summarized in the following table.

Pathogen group	Organism	Median LRV results during trial period	Tier 1 LRV requirements
Virus	Somatic coliphage	4.9	>1.0 (1)
	Male-specific coliphage	>3.1	
Bacteria	Total coliforms	6.4	>4.0 (2)
	E. coli	6.3	
Protozoa	C. perfringens	5.8	>2.5 (1)

(1) Tier 1 virus and protozoa credit from Salveson, A., Trussell, S., Linden, K., (2021). "Membrane Bioreactor Validation Protocols for Water Reuse - WRF Project 4997", Water Research Foundation, Denver, CO.
(2) Tier 1 bacteria credit from WaterSecure (2017). Membrane Bio-Reactor WaterVal Validation Protocol. Australian WaterSecure Innovations Ltd, Brisbane, Australia.

In addition to consistently excellent effluent quality ... we have had great support and technical assistance.

Erik Thornburgh
of Water & Wastewater Services, LLC

Complete our contact form to connect with a product expert

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